Dixie 1971

Branch of Forest Insect and Disease Prevention and Control
Division of Timber Management
Region 4 Forest Service
U.S. Department of Agriculture
Ogden, Utah

December 1971

Status of a Mountain Pine Beetle Outbreak in Ponderosa Pine in Bryce Canyon National Park and Dixie National Forest

Prepared by:

Douglas L. Parker

DOUGLAS L. PARKER, ENTOMOLOGIST
Section of Insect Detection and Evaluation

Recommended by:

Alfred M. Rivas

A. M. RIVAS, BRANCH CHIEF
Branch of Forest Insect and Disease
Prevention and Control

Approved by:

M. C. GALBRAITH

MARLIN C. GALBRAITH
Assistant Regional Forester
Division of Timber Management

dlifer 1971

INTRODUCTION

The present mountain pine beetle, Dendroctonus ponderosae Hopkins, outbreak in Bryce Canyon National Park and the East Fork of the Sevier River, Dixie National Forest, Utah, began in 1966. Annual aerial survey records show that the infestation increased from 1967 through 1969, especially on and around the Whiteman Bench area (see chart in Appendix). In 1970, the outbreak decreased in intensity, but widely scattered mortality was detected over a larger area. The infestation decreased in extent and intensity in 1971.[1/] A decreasing trend is expected again in 1972.

Two stand cruises were conducted within the most heavily infested area in Bryce Canyon National Park near Whiteman Bench to gain information on stand structures, sizes of trees attacked by the mountain pine beetle, and total stand mortality. The results of these surveys and a discussion of the findings follow:

METHODS

The variable plot method of cruising with a 20 basal area factor was used to obtain survey data. Critical angles were measured with a Spiegel-Relaskop. Trees were recorded in 2-inch diameter classes as follows: 5.0 to 6.9 inches d.b.h. (diameter at breast height) = 6-inch class, 7.0 to 8.9 inches d.b.h. = 8-inch class, etc. Twenty plots were sampled in each area with 10 plots on two lines. Plots were spaced at 10-chain intervals and lines were 20 chains apart. A computer program was used to obtain data summaries.

RESULTS

Area 1

Stands sampled in this area were composed mostly of ponderosa pine, Douglas-fir, and white fir (Fig. 1). There were some aspen stands in canyon bottoms and pinyon pine and juniper stands on open ridges on south exposures. Aspen, pinyon pine, and juniper were not recorded during the survey.

Ponderosa pine was the predominant tree species and was observed throughout the survey area. There was a wide distribution of diameter classes and also considerable variation in stand densities (Table 1). Dense stands were composed of trees from 6 to 12 inches d.b.h., while the open stands were composed of both small and large diameter trees.

1/ The 1971 aerial survey record in the chart in the Appendix indicates that the infestation increased over the 1970 level; however, a new aerial observer was being trained and he included some 1970 faders in the 1971 counts.

Figure 1. Aerial photograph of cruise Area 1, Bryce Canyon National Park. (See map in Appendix for location of cruise lines.)

Table 1. Stand structure, basal area, and statistical analyses for Area 1, Bryce Canyon National Park.

Diameter Class	Stand Structure Trees/Acre: Ponderosa Pine Live	Ponderosa Pine Dead	Ponderosa Pine Total	Douglas-Fir Live	Douglas-Fir Dead	White Fir Live	Total Stand
6	5.1	0	5.1	0	0	0	5.1
8	20.1	2.9	23.0	0	0	0	23.0
10	5.5	0	5.5	7.3	0	0	12.8
12	7.6	1.3	8.9	3.8	1.3	1.3	15.3
14	5.6	3.7	9.3	0	0	0	9.3
16	2.1	0	2.1	0.7	0.7	0.7	4.2
18	4.0	0	4.0	0	0	0.6	4.6
20	2.3	0.5	2.8	0	0	0.5	3.3
22	1.5	0	1.5	0	0	0	1.5
24	1.3	0	1.3	0	0.3	0	1.6
26	1.1	0	1.1	0.3	0	0	1.4
28	0.2	0	0.2	0	0	0	0.2
30	0.6	0	0.6	0	0	0	0.6
32	0.2	0	0.2	0	0	0	0.2
Total*	57.2	8.4	65.6	12.1	2.3	3.1	83.1
Percent	68.8	10.1	78.9	14.6	2.8	3.7	100.0

* Numbers have been averaged and vary slightly from statistical means.

	Ponderosa Pine Live	Ponderosa Pine Dead	Ponderosa Pine Total	Douglas-Fir Live	Douglas-Fir Dead	White Fir Live	Total
Basal Area Per Acre	55.0	7.0	62.0	9.0	3.0	4.0	78.0

Statistical Parameters	Ponderosa Pine Live	Ponderosa Pine Dead	Ponderosa Pine Total	Douglas-Fir Live	Douglas-Fir Dead	White-Fir Live	Total Stand
Mean per Plot	57.20	8.34	65.54	12.14	2.31	3.01	83.00
Standard Deviation	58.37	21.74	55.54	21.64	8.94	13.48	68.03
Standard Error	13.05	4.86	12.42	4.84	2.00	3.01	15.21
Coefficient of Variation (%)	102.05	253.83	84.74	178.25	387.01	447.81	82.00

Mike 1971

Mixed stands of Douglas-fir and white fir were observed on north and east facing slopes and generally were composed of small diameter trees in dense stands. An occasional large diameter Douglas-fir tree was recorded, but some of these were killed in past years by the Douglas-fir beetle, Dendroctonus pseudotsugae Hopkins.

Since the beginning of the outbreak, a total of 8.4 trees per acre have been killed by the mountain pine beetle in this area (Table 1). This loss amounts to 10.1 percent of the total stand and 12.8 percent of the ponderosa pine. A breakdown of mortality by diameter classes shows that most of the losses occurred in the 8- to 14-inch diameter classes. Trees in these diameter classes were usually killed in clumps (Fig. 2). Larger diameter trees were killed singly or in small groups. No new attacks were found in or between the sample points.

Refer to Table 1 for a summary of the basal area per acre and a statistical analysis of between plot variation.

Area 2

Stands in this area were composed mostly of ponderosa pine and Douglas-fir (Fig. 3). No white fir trees were recorded on cruise plots, but some were observed between plots. There were a few isolated stands of aspen in canyon bottoms. Scattered Douglas-fir trees killed by the Douglas-fir beetle were recorded in the area.

As in Area 1, ponderosa pine was the predominant tree species and occurred throughout the survey area. There was a wide distribution of diameter classes; however, there were more smaller diameter trees and dense stands than in Area 1 (Table 2).

The mountain pine beetle killed 10.8 trees per acre in this area (Table 2). The percent of mortality was 13.1 of the total stand and 14.4 of the ponderosa pine. As in Area 1, most of the mortality occurred in the smaller diameter classes. However, more medium diameter class trees were killed in this area. Smaller diameter trees were killed in groups and the medium and larger diameter trees were killed singly or in small groups. No new attacks were found in or between sample plots.

Refer to Table 2 for a summary of the basal area per acre and statistical analysis of between plot variation.

Dixie 1971

Figure 2. A group of small diameter trees killed by the mountain pine beetle in 1970 within cruise Area 1, Bryce Canyon National Park.

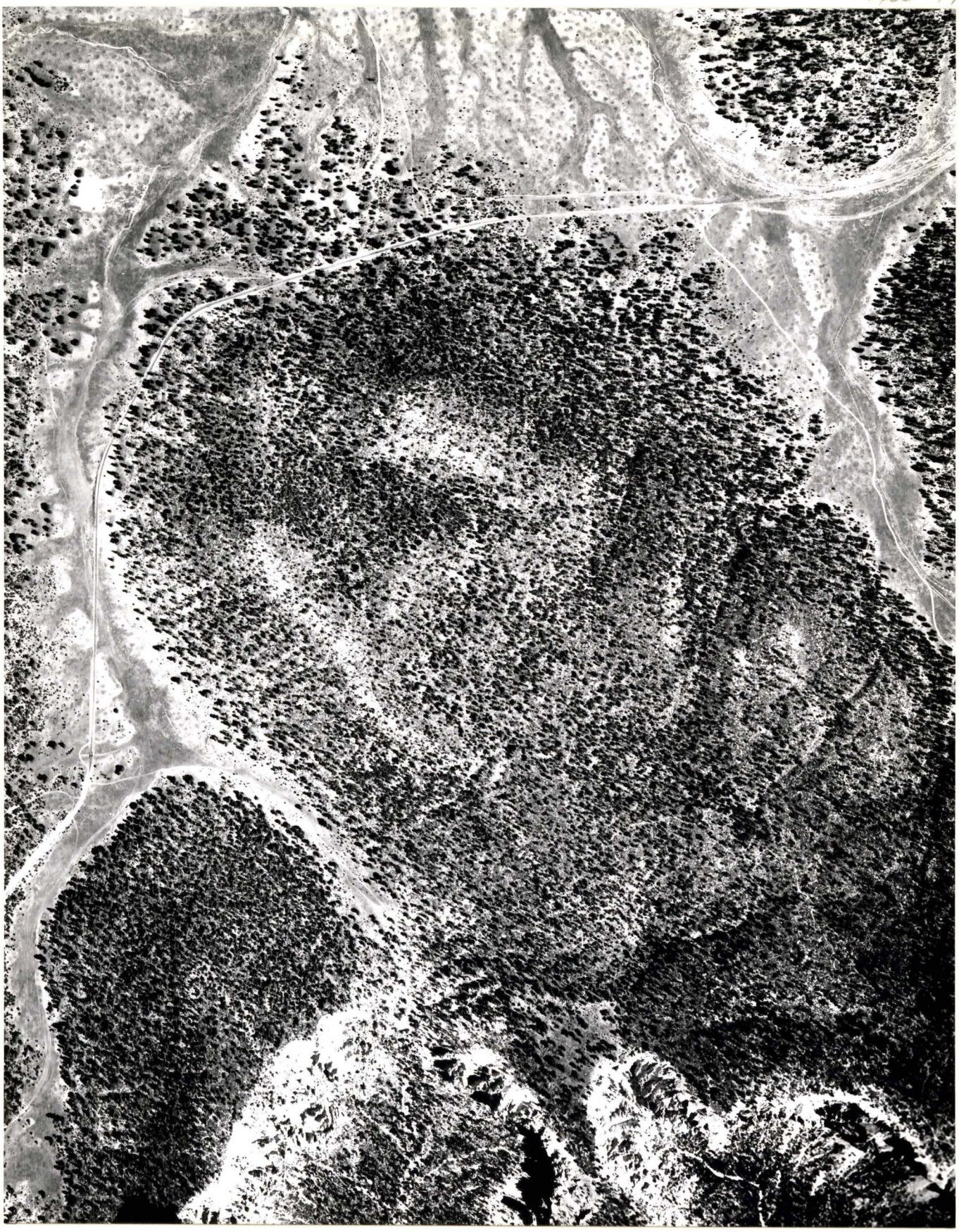

Figure 3. Aerial photograph of cruise Area 2, Bryce Canyon National Park. (See map in Appendix for location of cruise lines.)

Table 2. Stand structure, basal area, and statistical analyses for Area 2, Bryce Canyon National Park.

Diameter Class	Stand Structure (Trees/Acre)						
	Ponderosa Pine			Douglas-Fir		White Fir	Total
	Live	Dead	Total	Live	Dead	Live	Stand
6	25.5	0	25.5	0	0	0	25.5
8	20.1	2.9	23.0	2.9	0	0	25.9
10	3.7	3.7	7.4	0	1.8	0	9.2
12	1.3	1.3	2.6	0	0	0	2.6
14	2.8	0	2.8	0.9	0	0	3.7
16	3.6	1.4	5.0	0	0.7	0	5.7
18	3.4	0.6	4.0	0.6	0	0	4.6
20	0.9	0.5	1.4	0	0.5	0	1.9
22	1.9	0.4	2.3	0	0	0	2.3
24	0.3	0	0.3	0	0	0	0.3
26	0.5	0	0.5	0	0	0	0.5
28	0	0	0	0	0	0	0
30	0.2	0	0.2	0	0	0	0.2
Total*	64.2	10.8	75.0	4.4	3.0	0	82.4
Percent	77.9	13.1	91.0	5.4	3.6	0	100.0

*Numbers have been averaged and vary slightly from statistical means.

	Ponderosa Pine			Douglas-Fir		White Fir	Total
	Live	Dead	Total	Live	Dead	Live	
Basal Area Per Acre	40.0	9.0	49.0	3.0	3.0	0	55.0

Statistical Parameters	Ponderosa Pine			Douglas-Fir		Total Stand
	Live	Dead	Total	Live	Dead	
Mean per Plot	64.12	10.64	74.76	4.37	3.01	82.13
Standard Deviation	95.24	24.46	99.49	13.34	10.58	101.54
Standard Error	21.30	5.47	22.25	2.98	2.36	22.71
Coefficient of Variation (%)	148.53	229.89	133.08	305.26	351.50	123.63

Dixie 1971

CONCLUSIONS

The results of these two stand cruises, along with aerial survey records, have provided some insight into the trend and impact of mountain pine beetle outbreaks in ponderosa pine. Previously, there was little information, particularly from southern Utah, on these aspects. It should be emphasized, however, that the survey data are cursory and highly variable (Tables 1 and 2). The results only provide an indication of what has occurred in the cruise areas. Little is known about surrounding areas other than total tree mortality. Since the cruises were located where the heaviest cummulative mortality occurred, it can be concluded that losses elsewhere were not as high (see chart in Appendix).

The cruise data from both areas show that small diameter trees were attacked more frequently than medium and large diameter trees. Also, smaller diameter trees were killed in groups, while medium and larger diameter trees were killed singly or in small groups. Even though aerial and ground observations confirm these findings, more extensive sampling is required to substantiate this general trend. Future surveys are planned.

Tables 1 and 2 show that most of the larger diameter trees were not killed and most of the basal area per acre was recorded in living trees. Together, these data show that the mountain pine beetle did not destroy most of the merchantable trees and would not limit the possibility of managing the stands by logging. As an example, a 2,000-acre area was logged on Whiteman Bench in 1971. This sale was conducted where the heaviest losses were recorded during the past 6 years.

In the Park, there has been concern about the esthetic impact of the fading trees occurring along the scenic highway. To date, no formal complaints have been received concerning the dying trees. 1/ Information and education programs conducted by Park personnel apparently have been highly satisfactory. In a few years, there will be little red foliage remaining on the beetle-killed trees, and the stands will regain their former appearance. Further, the basic stand structure should not change due to the influence of the beetle.

The results of these cruises indicate that the damage to merchantable stands and scenic values is not as severe as once thought. In the past, periodic "control" operations were conducted to curb infestations and limit losses. The last operation started in 1951 and continued until 1961, during which 45,000 trees were felled and treated. Yet, in 1966, another infestation started. It is apparent that periodic beetle outbreaks will occur regardless of suppression

1/ Personal communication with Chief Ranger Ronald Trussel.

activities. Therefore, the most practical approach, considering all aspects, is to conduct salvage operations in areas where beetle losses are heaviest. In the Park, where logging is prohibited, beetle losses will have to be accepted as a natural occurrence. The only recommended procedure is to remove dead trees that present a hazard in campgrounds, etc.

Dec 1971

APPENDIX

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

3559 II NE (HENRIS FORK PEAK)

3559 II NW (BRYCE CANYON)

112°15' 7°37'30"

390000m E.

7 MI. TO UTAH 12

392 393 12'30" 394

5 MI. TO UTAH 54 & 22
BRYCE CANYON LODGE 0.2 MI.

R. 4 W. 10'

T. 36 S.
T. 37 S.

4164000m N.

4162

4161

35'

4160

KING CREEK CAMPGROUND 0.5 MI.

32 33 34 35 36
5 4 3 2 1
8 9 10 11 12
17 16 15 14 13

East Fork Sevier River
Johnson Hollow
Henderson Creek
East Creek
Tropic Reservoir
SPILLWAY ELEVATION 7835
Whiteman Spring
Shaker Spring
Trough Spring
BM 8378
BM 7998
Spring
BM 7909
BM 7824
Sunset Campground
Water Tanks
Siler City
Inspiration Point
Paria View
Well
Ingram Hollow
Canyon

BENCH
FOREST
WHITEMAN BENCH
DIXIE NATIONAL FOREST
PAUNSAUGUNT PLATEAU
PAUNSAUGUNT CLIFFS
NATIONAL MONUMENT

AREA 1
AREA 2

SCALE 1:24000

1 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 0 1 KILOMETER

CONTOUR INTERVAL 40 FEET
DOTTED LINES REPRESENT 20-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL